AMENDMENTS TO THE CLAIMS

1-5. (Cancelled)

6. (Previously Presented) A base station device having an antenna array, for receiving forward fading information from a mobile station in a mobile communication system, comprising:

a reverse processor for processing a reverse signal received through the antenna array;

a forward fading information extraction unit for extracting forward fading information from the received reverse signal;

a beam formation controller for generating a weight vector for formation of a transmission beam using the forward fading information and the received reverse signal; and

a forward processor having a transmission beam generator for generating a transmission beam for a transmission message based on the weight vector,

wherein the forward fading information extraction unit comprises:

a forward fading decoder for decoding forward fading information for each path fed back from a mobile station from the received reverse signal of the reverse processor; and

a forward fading extractor for extracting a forward fading coefficient from the decoded forward fading information; and

wherein if the decoded forward fading information is represented as complex information $\{\beta_i^F \underline{a}(\theta_i)^H \underline{w},\ i = 1,\ 2,\ \cdots,\ M\}$, the forward fading extractor extracts a complex forward fading coefficient $\{\beta_i^F,\ i - 1,\ 2,\ \cdots,\ M\}$ using a weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i),\ i - 1,\ 2,\ \cdots,\ M\}$ used for formation of the transmission beam.

7-8. (Cancelled)

9. (Previously Presented) The base station device of claim 6, wherein if the decoded forward fading information is represented as quantitative information $\{\left|\beta_i^F \underline{a}(\theta_i)^H \underline{w}\right|,\ i = 1,\ 2,\ \cdots,\ M\}$, the forward fading extractor extracts a forward fading severity

$\{|\beta_i^F|, i-1, 2, \cdots, M\}$ using a weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i), i-1, 2, \cdots, M\}$ used for formation of the transmission beam.

10. (Previously Presented) The base station device of claim 6, wherein the forward fading information extraction unit further comprises a memory for storing a predetermined number of previous forward fading coefficients.

11. (Previously Presented) The base station device of claim 6, wherein the beam formation controller comprises:

a forward fading power calculator for calculating forward padding power for each path based on the extracted forward fading information;

an array vector calculator for calculating an array vector for each path from the received reverse signal;

a transmission correlation matrix calculator for calculating a transmission correlation matrix based on the forward fading powers and the array vectors; and

a weight vector calculator for calculating a weight vector from the transmission correlation matrix, updating the previous weight vector with the calculated weight vector, and outputting the updated weight vector as a control signal to the transmission beam generator.

12. (Original) The base station device of claim 11, wherein the forward fading power calculator comprises an average reverse fading power calculator for calculating an average reverse fading power for each path from the reverse signal and a Doppler frequency estimator for estimating a mobility of the mobile station, for calculating the forward fading power using the forward fading information, the reverse fading power, and the Doppler frequency according to a feedback delay time and a movement speed of the mobile station.

13. (Original) The base station device of claim 11, wherein the forward fading power calculator receives the extracted forward fading coefficient for each path and outputs forward fading power for each path if a variation of the feedback time delay is small.

14. (Original) The base station device of claim 11, wherein the forward fading power calculator calculates a current forward fading coefficient for each path by a predetermined prediction method using the plurality of previous forward fading coefficients for each path, an average reverse fading power for each path, and the Doppler frequency for each path if a variation of the feedback time delay is great.

15. (Previously Presented) The base station device of claim 14, wherein the forward fading power calculator calculates the current forward fading coefficient for each path $\{\beta_i^F[k], i = 1, 2, \cdots, M\}$ by a predetermined linear prediction method using the plurality of previous forward fading coefficients for each path $\{\beta_i^F[k-D], \beta_i^F[k-D-1], \cdots, \beta_i^F[k-D-V+1], i = 1, 2, \cdots, M\}$ (where D is a unit delay time of forward fading information between the base station and the mobile station), the average reverse fading power for each path $\{E[|\beta_i^R|^2], i = 1, 2, \cdots, M\}$, and the Doppler frequency for each path $\{f_{D,i}, i = 1, 2, \cdots, M\}$, and then generates the forward fading power for each path $\{p_i\} = \{|\beta_i^F|^2, i = 1, 2, \cdots, M\}$.

16. (Previously Presented) The base station device of claim 14, wherein the forward fading power calculator calculates a current forward fading severity for each path $\{|\beta_i^F[k]|, i = 1, 2, \cdots, M\}$ by a predetermined linear prediction method using a plurality of previous forward fading severities for each path $\{|\beta_i^F[k-D]|, |\beta_i^F[k-D-1]|, \cdots, |\beta_i^F[k-D-V+1]|, i = 1, 2, \cdots, M\}$ (where D is a unit delay time of forward fading information between the base station and the mobile station), the average reverse fading power for each path $\{E[|\beta_i^R|^2], i = 1, 2, \cdots, M\}$, and the Doppler frequency for each path $\{f_{D,i}, i = 1, 2, \cdots, M\}$, and then generates the forward fading power for each path $\{p_i\} = \{|\beta_i^F|^2, i = 1, 2, \cdots, M\}$.

17. (Original) The base station device of claim 13, wherein the forward fading power calculator further comprises:

a mobility estimator for estimating the mobility of the mobile station; and

a selector for receiving the average reverse fading power for each path from the average reverse fading power calculator and the forward fading power for each path and selecting the forward fading power if the mobility is lower than a predetermined threshold and the average reverse fading power if the mobility is greater than the threshold.

18. (Previously Presented) The base station device of claim 17, wherein the mobility estimator estimates the Doppler frequency for each path $\{f_{D,i}, i = 1, 2, \cdots, M\}$ from the received reverse signal.

19. (Original) The base station device of claim 12, wherein the forward fading power calculator further comprises:

a mobility estimator for estimating the mobility of the mobile station; and

a selector for receiving the average reverse fading power for each path from the average reverse fading power calculator and the forward fading power for each path and selecting the forward fading power if the mobility is lower than a predetermined threshold and the average reverse fading power if the mobility is greater than the threshold.

20. (Previously Presented) The base station device of claim 19, wherein the mobility estimator estimates the Doppler frequency for each path $\{f_{D,i}, i = 1, 2, \cdots, M\}$ from the received reverse signal.

21. (Previously Presented) The base station device of claim 11, wherein the array vector calculator calculates an array vector $\{\underline{a}(\theta_i), i = 1, 2, \cdots, M\}$ directly from the reverse signal.

22. (Previously Presented) The base station device of claim 21, wherein the transmission correlation matrix calculator calculates a transmission correlation matrix $G = \sum_{i=1}^{M} p_i \underline{a}(\theta_i)\underline{a}(\theta_i)^H$ using the array vector $\{\underline{a}(\theta_i), i = 1, 2, \cdots, M\}$ and the forward fading power $\{p_i, i = 1, 2, \cdots, M\}$.

23. (Original) The base station device of claim 22, wherein the weight vector calculator calculates a maximum unique vector corresponding to a maximum unique value of the transmission correlation matrix, normalizes the maximum unique vector, and outputs the normalized maximum unique vector as the weight vector.

24. (Original) The base station device of claim 23, wherein the transmission beam generator forms a transmission beam by generating as many duplication signals of a transmission message as the number of antennas in the antenna array and multiplying the duplication messages by weight vector components.

25. (Cancelled)

26. (Cancelled)

27. (Cancelled)

28. (Cancelled)

29. (Cancelled)

30. (Cancelled)

31. (Cancelled)

32. (Cancelled)

33. (Previously Presented) A transmitting method for a base station that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising the steps of:

processing a reverse signal received through the antenna array;

extracting forward fading information from the processed reverse signal;

generating a weight vector using the forward fading information and the received reverse signal; and

forming a transmission beam for a transmission message based on the weight vector,

wherein if the forward fading information is represented as complex information $\{\beta_i^F \underline{a}(\theta_i)^H \underline{w},\ i=1,\ 2,\ \cdots,\ M\}$, the forward fading extractor extracts a complex forward fading coefficient $\{\beta_i^F,\ i-1,\ 2,\ \cdots,\ M\}$ using a weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i),\ i-1,\ 2,\ \cdots,\ M\}$ used for formation of the transmission beam; and

wherein if the forward fading information is represented as quantitative information $\{\left|\beta_i^F \underline{a}(\theta_i)^H \underline{w}\right|,\ i=1,\ 2,\ \cdots,\ M\}$, the forward fading extractor extracts a forward fading severity $\{\left|\beta_i^F\right|,\ i-1,\ 2,\ \cdots,\ M\}$ using the weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i),\ i-1,\ 2,\ \cdots,\ M\}$ used for formation of the transmission beam.

34. (Previously Presented) A communication method for a mobile station in a mobile communication system, comprising the steps of:

processing a received forward signal;

estimating forward fading information of the forward signal for each path;

combining the estimated forward fading information and encoding the combined forward fading information; and

multiplexing the encoded forward fading information with a transmission message and feeding back the forward fading information in the multiplexed signal to a base station,

wherein the forward fading estimator estimates complex forward fading information $\{\beta_i^F \underline{a}(\theta_i)^H \underline{w}, i=1,2,\cdots,M\}$ from the forward signal and estimates forward fading severity information $\{\left|\beta_i^F \underline{a}(\theta_i)^H \underline{w}\right|, i=1,2,\cdots,M\}$ from the forward signal; and

wherein if the forward signal forms an omnidirectional beam, the forward fading estimator estimates the complex forward fading information $\{\beta_i^F, i=1,2,\cdots,M\}$ and the estimates forward fading severity information $\{\left|\beta_i^F\right|, i=1,2,\cdots,M\}$.

35. (Previously Presented) A communication method between a base station having an antenna array and a mobile station, comprising the steps of:

estimating forward fading information of a forward signal received from the base station for each path, combining the estimated forward fading information, encoding the combined forward fading information, and feeding back the encoded forward fading information to the base station in the mobile station;

extracting the forward fading information and generating a weight vector using the extracted forward fading information in the base station; and

forming a transmission beam for a transmission message based on the weight vector and outputting the transmission beam through the antenna array in the base station,

wherein if the forward fading information is represented as complex information $\{\beta_i^F \underline{a}(\theta_i)^H \underline{w},\ i=1,\ 2,\ \cdots,\ M\}$, a forward fading extractor extracts a complex forward fading coefficient $\{\beta_i^F,\ i-1,\ 2,\ \cdots,\ M\}$ using a weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i),\ i-1,\ 2,\ \cdots,\ M\}$ used for formation of the transmission beam;

wherein if the forward fading information is represented as quantitative information $\{\left|\beta_i^F \underline{a}(\theta_i)^H \underline{w}\right|,\ i=1,\ 2,\ \cdots,\ M\}$, the forward fading extractor extracts a forward fading severity $\{\left|\beta_i^F\right|,\ i-1,\ 2,\ \cdots,\ M\}$ using the weight vector $\underline{w}$ and an estimated array vector $\{\underline{a}(\theta_i),\ i-1,\ 2,\ \cdots,\ M\}$ used for formation of the transmission beam;

wherein a forward fading estimator estimates complex forward fading information $\{\beta_i^F \underline{a}(\theta_i)^H \underline{w}, i=1,2,\cdots,M\}$ from the forward signal and estimates forward fading severity information $\{\left|\beta_i^F \underline{a}(\theta_i)^H \underline{w}\right|, i=1,2,\cdots,M\}$ from the forward signal; and

wherein if the forward signal forms an omnidirectional beam, the forward fading estimator estimates the complex forward fading information $\{\beta_i^F, i=1,2,\cdots,M\}$ and the estimates forward fading severity information $\{\left|\beta_i^F\right|, i=1,2,\cdots,M\}$.

36. (Previously Presented) A base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising:

a reverse processor for processing a reverse signal received through the antenna array;

a forward fading information extraction unit for extracting forward fading information from the received reverse signal;

a forward fading power calculator for calculating a forward fading power for each path based on the extracted forward fading information;

an array vector calculator for calculating an array vector for each path from the reverse signal;

a transmission correlation matrix calculator for calculating a transmission correlation matrix using the forward fading powers and the array vectors;

a weight vector calculator for calculating a weight vector from the transmission correlation matrix, updating an existing weight vector with the calculated weight vector, and outputting the updated weight vector as a control signal to a transmission beam generator; and

a forward processor comprising the transmission beam generator for generating a transmission beam for a transmission message based on the weight vector;

wherein the forward fading information extraction unit comprises:

a forward fading decoder for decoding forward fading information for each path fed back from a mobile station from the received reverse signal of the reverse processor; and

a forward fading extractor for extracting a forward fading coefficient from the decoded forward fading information.

37. (Original) A base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising:

a reverse processor for processing a reverse signal received through the antenna array;

a forward fading information extraction unit for extracting forward fading information from the received reverse signal;

a forward fading power calculator for calculating an average reverse fading power and a Doppler frequency from the received reverse signal and calculating a current forward fading power for each path by a predetermined prediction method based on a plurality of previous forward fading coefficients for each path, the average reverse fading power, and the Doppler frequency;

an array vector calculator for calculating an array vector for each path from the reverse signal;

a transmission correlation matrix calculator for calculating a transmission correlation matrix using the forward fading powers and the array vectors;

a weight vector calculator for calculating a weight vector from the transmission correlation matrix, updating an existing weight vector with the calculated weight vector, and outputting the updated weight vector as a control signal to a transmission beam generator; and

a forward processor comprising the transmission beam generator for generating a transmission beam for a transmission message based on the weight vector.

38. (Previously Presented) A base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising:

a reverse processor for processing a reverse signal received through the antenna array;

a forward fading information extraction unit for extracting forward fading information from the received reverse signal;

a forward fading power calculator for calculating forward fading power for each path based on the extracted forward fading information, calculating an average reverse fading power from the reverse signal, and selecting the forward fading power if the mobility of the mobile station is lower than a predetermined threshold and the average reverse fading power if the mobility of the mobile station is greater than the threshold;

an array vector calculator for calculating an array vector for each path from the reverse signal;

a transmission correlation matrix calculator for calculating a transmission correlation matrix using the forward fading powers and the array vectors;

a weight vector calculator for calculating a weight vector from the transmission correlation matrix, updating an existing weight vector with the calculated weight vector, and outputting the updated weight vector as a control signal to a transmission beam generator; and

a forward processor comprising the transmission beam generator for generating a transmission beam for a transmission message based on the weight vector;

wherein the forward fading information extraction unit comprises:

a forward fading decoder for decoding forward fading information for each path fed back from a mobile station from the received reverse signal of the reverse processor; and

a forward fading extractor for extracting a forward fading coefficient from the decoded forward fading information.

39. (Original) A base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising:

a reverse processor for processing a reverse signal received through the antenna array;

a forward fading information extraction unit for extracting forward fading information from the received reverse signal;

a forward fading power calculator for calculating an average reverse fading power and a Doppler frequency from the received reverse signal, calculating a current forward fading power for each path by a predetermined prediction method based on a plurality of previous forward fading coefficients for each path, the average reverse fading power, and the Doppler frequency, and selecting the forward fading power if the mobility of the mobile station is lower than a predetermined threshold and the average reverse fading power if the mobility of the mobile station is greater than the threshold;

an array vector calculator for calculating an array vector for each path from the reverse signal;

a transmission correlation matrix calculator for calculating a transmission correlation matrix using the forward fading powers and the array vectors;

a weight vector calculator for calculating a weight vector from the transmission correlation matrix, updating an existing weight vector with the calculated weight vector, and outputting the updated weight vector as a control signal to a transmission beam generator; and

a forward processor comprising the transmission beam generator for generating a transmission beam for a transmission message based on the weight vector.

40. (Previously Presented) A forward signal transmitting method for a base station that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising the steps of:

decoding the forward fading information for each path fed back from a mobile station from the received reverse signal of the reverse processor;

extracting a forward fading coefficient from the decoded forward fading information;

calculating a forward fading power for each path based on the extracted forward fading coefficient;

calculating an array vector for each path from the reverse signal;

calculating a weight vector based on the forward fading powers and array vectors and updating an existing weight vector with the calculated weight vector; and

forming a transmission beam for a transmission message based on the weight vector and outputting the transmission beam through the antenna array.

41. (Original) A forward signal transmitting method for a base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising the steps of:

extracting forward fading information from a reverse signal received through the antenna array and storing the extracted forward fading information;

calculating an average reverse fading power and a Doppler frequency from the received reverse signal and calculating a current forward fading power for each path by a predetermined prediction method based on a plurality of previous forward fading coefficients for each path, the average reverse fading power, and the Doppler frequency;

calculating an array vector for each path from the reverse signal;

calculating a weight vector based on the forward fading powers and array vectors and updating an existing weight vector with the calculated weight vector; and

forming a transmission beam for a transmission message based on the weight vector and outputting the transmission beam through the antenna array.

42. (Previously Presented) A forward signal transmitting method for a base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising the steps of:

decoding the forward fading information for each path fed back from a mobile station from the received reverse signal of the reverse processor;

extracting a forward fading coefficient from the decoded forward fading information;

calculating forward fading power for each path based on the extracted forward fading coefficient, calculating an average reverse fading power from the reverse signal, and selecting the

forward fading power if the mobility of the mobile station is lower than a predetermined threshold and the average reverse fading power if the mobility of the mobile station is greater than the threshold;

calculating an array vector for each path from the reverse signal;

calculating a weight vector based on the forward fading powers and array vectors and updating an existing weight vector with the calculated weight vector; and

forming a transmission beam for a transmission message based on the weight vector and outputting the transmission beam through the antenna array.

43. (Original) A forward signal transmitting method for a base station device that has an antenna array and received forward fading information from a mobile station in a mobile communication system, comprising the steps of:

extracting forward fading information from a reverse signal received through the antenna array;

calculating an average reverse fading power and a Doppler frequency from the received reverse signal, calculating a current forward fading power for each path by a predetermined prediction method based on a plurality of previous forward fading coefficients for each path, the average reverse fading power, and the Doppler frequency, and selecting the forward fading power if the mobility of the mobile station is lower than a predetermined threshold and the average reverse fading power if the mobility of the mobile station is greater than the threshold;

calculating an array vector for each path from the reverse signal;

calculating a weight vector based on the forward fading powers and array vectors and updating an existing weight vector with the calculated weight vector; and

forming a transmission beam for a transmission message based on the weight vector and outputting the transmission beam through the antenna array.